

Delay Analysis of National Highway NH-44 Using Primavera Software

Indrajeet Kumar, Afzal Khan

Department of Civil Engineering, Millennium Institute of Technology, Bhopal, Madhya Pradesh, India

ABSTRACT

Nowadays the planned duration is one of the main criteria when judging whether a construction project is a failure or not. Additionally, construction designing is claimed to achieve success if the project completes inside the planned duration; or if it identifies a problem well prior to, thereby alerting the project management team to resolve the problem before it causes any impact on the completion date. This analysis of the National Highway Dewas- Ujjain delay factors was investigated. Participant observation was adopted an approach has advised that from the descriptive principles of anthropology? Success factors related to say and. It is argued that this project a shadow culture exists among participants, an embedded interactive supervisor perspective angle just clear that was found. Designing method and its effectiveness planning this shadow culture within the team and immediately the quality of relationships between the stakeholders associated with human difference management serves to modify. The analysis concludes by questioning the parable amongst project participants that construction coming up with could be a mechanistic method that has got to be conducted entirely by the look team.

KEYWORDS: Delay analysis, construction project, case study, National Highway

INTRODUCTION

In recent years, Indian economy has improved largely, following the growth of oil sector, infrastructure development and the urbanization are booming. And yielding with them, the burden (importance) of the development trade within the economic system has been increasing. However, the development project is many problems arising during implementation; there is a delay at all. On the date of completion or far side so much when on the far side in a contract, the parties are in agreement laid out for the delivery of the project informed date because delays might be outlined. An important critique of the Iraqi housing industry is facing increasing delay in the project delivery rate. It comes finishing time is power, but results from a variety of sources and method development many variables are subject to unpredictable factors. These sources accessible performance teams, resources, environmental conditions, parties and embody the involvement of relations written agreement.

However, it is rarely the time required between a project has been completed that is happening. Owner, construction delays revenue, productivity, reliance on existing facilities, the lack of loss of rentable facilities etc. refers to. For contractors, construction delays top prices, long work length, high labor costs, materials and redoubled instrumentation refers to prices etc. Upon completion of the construction of the nominal time or work time agreement between the parties and power points.

LITERATURE SURVEY LITERATURE REVIEW GENERAL

The research papers from scholars, researchers and scientists were summarized in the section who have been continuously working towards identification of new methods for planning and scheduling of construction projects and case study to make the currency construction industry to be purposeful and most effective in handling mega projects.

How to cite this paper: Indrajeet Kumar | Afzal Khan "Delay Analysis of National Highway NH-44 Using Primavera

Software" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-8 |

Issue-2, April 2024, pp.40-57, URL: www.ijtsrd.com/papers/ijtsrd64558.pdf



IJTSRD64558

Copyright © 2024 by author (s) and International Journal of Trend in Scientific Research and Development Journal. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0) (<http://creativecommons.org/licenses/by/4.0>)



CRITICAL OBSERVATION BY DIFFERENT AUTHORS

Balakrishna Ch et.al (2021) in the research paper, schedule delay analysis was conducted on the construction of a multistoried residential project and the factors and parties responsible for the delays are found out. Many unforeseen factors and ignored issues that lead to the delay are identified. Using various features and tools of Primavera software, the schedule delay analysis is conducted, and an alternate schedule is created with increased resources and time so that it reduces the effect of delays, which would be worthwhile to the contractor and all other parties involved in the project.

Results stated that the updated duration after completion of the project is 705 days. Constraints are not properly assigned to the critical activities, which led to delay of several activities. The contractor was observed to be the cause of delay for various factors. Out of the 15 parameters, 4 were observed to be excusable and the other parameters lead to the delay in critical activities. After the proposed schedule, the duration of the project is reduced by 45 days. The actual duration of the project is 705 days but the duration of the proposed schedule is 660 days.

A. S. Harle and R. D. Shinde (2020) objective of the research paper was to classify the main reasons of interruptions, the belongings of delays, and systems of reducing delays in creation plan. This work focus on delay analysis in construction with different measures. This work also investigates the interruption of time as well as cost maximization with different factors. The work and scheduling were done using MSP 2013.

The mission plan increases day by day cost due to sudden requirement of labor or any unavoidable circumstances thus, it has an impact on the overall cost of the mission. Duration is increased for decline in source constraints. The different factor may affect on delay in construction, but user can eliminate such delay suing proper planning as well as scheduling.

Praveen Kumar.S and A.Krishnamoorthi (2020) Planning and scheduling helps in future situation and implementation of the project. The Primavera Software provides user friendly options while performing any task. The cost of individual work break down can be known along with the duration. Thus decisions can be made sensibly for proper management. In multiple projects resource leveling is very important to maintain proper resource allocation. For multiple projects under a single company such analysis should be done to check out for over allocation. Scheduling real-time projects is also an important standard for managing multiple projects. A

Resource constrained project schedule as per the site situation. For resource constrained analysis resource leveling is arranged. Scheduling using Microsoft project Software gives good controlling and clear schedule to a project. This project dealt with scheduling using Microsoft project.

SelvaKumar M and Manishankar S (2020) objective of the research paper was to inspect the deferments in an advancement adventure by distinct composing study, site activities, and discernments made. Low down composing assignment to describe the various reasons for deferment being developed endeavors. Research on advancing Project site to watch the activities and to recognize delay factors. Confirmation of Critical Path using Primavera. The assessment similarly incorporates the path toward booking and following an improvement adventure development in programming and related to getting the ball rolling projects in light of deferrals. The Primavera Software offers simple to utilize decisions while playing out any endeavor. The cost of individual work separately can be known close by length. From our assessment, it might be shut if the Construction started in September 2018. The size of the Project as per standard Schedule is 730 days. Following April 2020 revealed 9.96% completing road works, 34.18% structure work, and 0.78% of various positions, the assignment's overall fulfillment is 20.00%.

Purposes behind deferral in my assignment are recognized by the direct visit and predict the endeavor's fulfillment's unpleasant date. The monumental purposes behind deferrals in our road adventure are Granting Permission for isolating soil from cart locale, Physical responsibility for undertaking site/Land getting, Issuance of NOC by PWD/WRO, Govt. of Tamil Nadu, Shifting of Utilities, Cyclone "GAJA"/Rain and Corona Pandemic COVID-19. The transitory laborer has introduced its revised advancement plan as per the conditions of arrangement and solicitation time growth of 364 days. The altered advancement plan has no association with the primary embraced base Schedule.

Dilip Kumar E and Manishankar S (2019) the objective of the research paper was determination of critical path using Primavera. The analysis also involved scheduling and tracking a construction project activity in software and related catch-up programs due to delays. The Construction started in February 2016, and the duration of the Project as per the baseline Schedule is 988 days. Tracking till April 2019 revealed 99% completion of foundation and substructure work and 100% casting of precast

segments, and 64% erection of segments, overall completion of the project is 58%. Causes of delay in project were identified by a direct site visit and predict the project's approximate date. In the case study, the most important causes of delays in bridge project were traffic permission/diversion delay because the project was located at five road junctions to bus stand, delay in utility shifting/diversion, delay in design works, shortage of resources, and land acquisition delay.

Suvarna N. Desai and Dr. A. W. Dhawale (2019) objective of the research paper was to plan, schedule, and track industrial project with the help of primavera software. In large scale project preparing accurate plan is very difficult. Computer packages like MS project and primavera project planner are used in construction industry.

Results stated that primavera software helps to proper management and save time in all phase of construction. Critical path scheduling is done by using primavera. It helps identify the critical activity and suggesting suitable major using primavera. Problem in construction, design, planning etc. like improper co-ordination between contractor and onsite working people, wastage of material etc. by using primavera improper co-ordination between contractor and working people is reduce then it helps to reduce the cost of construction.

Chaitali B Guledagudd and Vijay B G (2018) research paper dealt with scheduling and monitoring ongoing bypass construction connecting NH 218 and NH 63 using project management software Primavera P6. The length of this project bypass was 11.5 Kms, out of which, 3.80 Kms is being constructed by NH (PWD) Division, Hubli and balance stretch of 7.7 Kms is under construction by NHAI. Total width of land acquired for bypass construction is 60 mts in general and varies at junctions & interchanges. 4-Lane configuration of flexible pavement with median, lighting, construction of RE wall, ROB, minor bridges, culverts and VUPs etc., This project was having most of the variety of civil engineering structures. Reasons for cost variation and delays in construction of current project was identified and importance of scheduling and monitoring of construction work to complete the project within time and cost was analyzed.

Cost performance index [CPI] was 0.62, less than 1, specifies project has got poor performance cost wise. 12. Schedule performance index [SPI] was 0.61, less than 1, specifies project has got poor performance in terms of scheduled dates. Organization now has believed that monitoring and tracking the project performance utilizing primavera software P6 is

beneficial to have a more accurate observation on contractor's actions.

Parth Viradia and B Prakash Rao (2018) objective of the research paper was to plan and schedule the construction process of a building in Manipal and to identify the causes of delays. Since many unforeseen circumstances arose during the construction, the prior schedule was updated and the newer schedule was followed. Oracle's Primavera P6 has been used for the scheduling of this project. Planning and scheduling of the building was achieved through the following steps: creating an EPS (Enterprise Project Structure), creating a WBS (Work Breakdown Structure), linking of activities according to their interdependencies as well as relations and delay analysis. The final updated schedule was compared with the original schedule to perform a thorough delay analysis.

By observation of the updated schedule, it was evident that the finishing stage which includes external and internal painting, block work, flooring, etc. was the most time consuming. Improper communication between contractors and the planning department was observed to be the foremost cause for most delays. Activities that caused delays to the project were identified and rescheduled appropriately. Delay due to the excavation and dewatering processes had a major impact as it rendered various other activities on hold due to labor re-allotment. Delay during excavation due to natural causes could have been anticipated by the engineers and definite precautions to thwart exposure could have been implemented. Bricks used for cladding required special and superior curing techniques that the labor was not familiar with. Hence it was not completed on schedule. Importing of foreign fixtures and furniture caused delay due to improper communication. Better communication could have been established between local and foreign engineers which would eliminate delays in the fountain work.

P. P. Bagde and A. N. Bhirud (2018) here in the research, author chose a bridge project site located in Bhandara, Maharashtra on National Highway No. 6. There were more than 50 activities which gave the complete clarity of planning of a project.

Control over the cost, management of time, management of working hours, update and monitoring carried out in a proper manner. Paperless project management at site can be done. Comparing multiple projects at the same time can be done in primavera very easily at a same window. Proper resource optimization is possible during levelling of resources based on required conditions and constraints.

R.S. Kumar and A. J. Antony (2018) objective of the research paper was to preplan and schedule the activities of a project for acquiring budgeted cost and adopt the proper activity sequencing by assigning proper relationship between activities using Primavera P6.

Results stated that the actual duration of the project as per original schedule is 18 months i.e. 540 days .As per preplanning and scheduling the project by using primavera the project can be completed by 505 days , which gives 35 days earlier than the actual duration. The Earth work can be completed within 412 days and have a total float of 93 days with a budgeted cost of Rs.2218130.88. Hence the Contractor or the management could get a profit of 15.2% of project budget at the time of completion i.e. Rs.11680773.70.

Saradha.P and R.Santhosh Kumar (2018) research paper focused on study of core factors that are causing delays and analyzing the day-today records to minimize delays. To overcome the problem, research induced to collect the day-to-day data site work i.e. starting time, finishing time and completed task etc. are recorded in MS Project differentiating task and critical activity along with the delays caused and reasons for the delays. The collected data was analyzed using MS project and the priority of the delay has predict using SPSS software on ranking basis.

Analysis results from software shows the critical influences in project scheduling are listed. The management of time is very critical in this industry because time equals to money thus estimating chances of schedule delay may play a significant role in the direction of project success. Relative importance index method used to prioritize the factors which are critical delay and its significance level compared to other factors. Based on these risk factors allocate in the project schedule, delay for the duration of the whole project can save money and time. Because of the difficulty and lengthy time of projects, Investment and risks are more in this industry. Delay in designed schedule of project was the basic reason for these disadvantages.

T.Subramani et.al (2018) the primary objective of research was to identify the major causes of delays of building construction projects using a survey and investigate the reasons for cost and time overrun in construction project. Regression models are obtained using SPSS software.

The research established that contractor's technical staff is insufficient and ineligible to accomplish the project, lack of communication between the construction parties, and unavailability of experienced

staff in the owner's and contractor's teams during the project execution are the major factors responsible for causing schedule delay, cost overrun, and quality shortfall respectively. In addition, recommendations for avoiding and overcoming the negative implications of these factors on the performance of the public highway projects.

Kartik Bagrecha and Ayushi Bais (2017) objective of the research paper was to examine ways to minimize the cause of build delays, delays, and build delays. Project delays include several factors such as missing funds, changes in the drawings, lack of effective communication and inadequate project management.

Results stated that the number of time delays and cost increases (spills) increases with the total project cost. Claims for losses and reimbursements due to delays and fluctuations in claims during the extension period have a significant impact on cost overruns.

Sushma.H et.al (2017) Primavera P6 gives a proper project management solution for the planning and scheduling team of the enterprise. Planning and scheduling is very important in construction projects for reducing and controlling delays of the project. Substantial amount of time, money, resources are wasted each year in a construction industry due to improper planning and scheduling. With globalization the construction projects have become vast and complex. Planning of such requires huge amount of paper work, which can be reduced with the help of project planning software. Providing good planning, sufficient of flow of resources to a project can be automatically achieved desired result.

S.Revathy and Dr. S. Kamal (2017) research paper attempted to identify the critical activities responsible for schedule overrun. Data was collected through Secondary data method such as scheduling of the project and project information to assess the extent of schedule overruns. The result of the study revealed the main critical activities causing schedule overrun such as pump and motor fixing design, pollution control approval, Filling for basement with quarry dust, PCC, Staircase shuttering, Concreting for flooring, Lift wall shuttering, Wall shuttering and concreting, Excavation for sump, Parapet wall masonry, Water proofing, supply and fixing of doors and windows, Ground water (bore wells) and also presented a possible suggestions to get the optimum result to avoid rescheduling and to complete the project within planned duration.

The delay of milestones was ranked on the basis of average percentage delay. The result obtained in this study mainly focused on building projects. The

maximum 50% projects are in 1 to 20 months. Hence the result of the more applicable for the project duration lies in 1 to 20 months. The maximum 67% projects are in 1 to 50 Cr. Hence the result of the more applicable for the project budget lies in 1 to 50 Cr.

A. T. Multashi and R. R. Salgude (2016) The aim of this analysis was to analyze the factors that influence the success of construction coming up with of Alkut Olympic sports stadium and delay analysis case study. Overview technology coming up with the last complete challenges related to manufacturing and even to understand the method of construction was adopted from the East. Before you install with Preconstruction well planning and procurance special constructions immediately before the commencement of part to progress with coming to be very useful. SRM helped come up with throughout the preconstruction that major problem preconstruction stage a project team was formed and the project completion was maintained the same team. Most were very committed top management of the contractor and method targeted in coming up with. Coaching for project personnel is coming alongside the law their full support was given to increase. Engineers were trained to become the Manager and who's coming with that it is supported by the entire project team is able to achieve success can be a way to educate.

P. Esakki Thangam and R. Magdalene Benila (2016) main objective of project was to prepare the proper planning and scheduling for the 6 lanes road work construction at VOC PORT TRUST, Tuticorin. Time management and time control are done by primavera P6 software. The main advantage of project was timely execution and completion of the project using primavera P6 software. The road construction project has completed prior to the contract duration.

I. Michael Raj and M. Panimalar (2015) objective of the research paper was to look at the management of the delayed completion on construction comes and therefore the objectives of this study square measure to judge the degree of delay on construction comes, to identify the notification of delay on construction projects and to investigate the respondent's actions when rectifying the delayed completion. For the successful completion of a project, planning and scheduling are two most important factors. The demand of industry needs a definite designing, scheduling and management which can allow the overall optimization of the cost, time and resources.

According to the TIA schedule delay analysis the delays due to the critical activities extended the project duration by 203 days in totality i.e. by 26% of

the estimated construction period. On the other hand, the delays due to the noncritical activities did not impact the total duration. The reason for selecting the Time Impact Analysis (TIA) method was that it can show the progress of construction works step by step with the assistance of PRIMAVERA® package.

METHODOLOGY

The steps involved in planning and scheduling of construction projects using primavera P6 are summarized in this section.

Project Planning

Project planning is a very fundamental and challenging activity to execute work in all construction projects. Planning involves listing activities or tasks in a project, manpower, listing the requirement of materials, types of machinery, and money to accomplish the tasks. Also, cost estimation is done through the planning process.

A good planning process helps in budgeting and in preparing the schedule for the work. The main objective of project planning is to identify the various tasks and activities required to accomplish work and estimate the proper time to accomplish that particular activity considering interrelationship with other sequential activities involved in that work. Developing a proper plan in any project is a very critical task. Proper logic, time analysis, and scheduling are included in project planning. For a planning process, inputs will be taken from estimating departments, project managers, field engineers, foremen, and contractors. Proper planning helps in providing adequate resources and time to accomplish the activities. A plan includes the following terms:

- A. Budget
- B. Estimate
- C. Schedule
- D. The sequence of completion of each part of work
- E. Cash flow budget
- F. Manpower planning
- G. Equipment and material planning.

Steps involved in Project Planning

Project planning involves the following steps:

- A. Define the scope of work
- B. Preparing a list of activities to be performed
- C. Preparing network diagram or logic to establish the relationship among different activities
- D. Analyzing the network diagram to work out project period, vital and noncritical activities during a project
- E. Determine the critical path with the assistance of critical activities Establish standards for the resources (material, men, machinery, and money)
- F. Resources allocation
- G. Forecasting budget allocation to achieve the target

- H. Organization of project information
- I. Recording the status report of every activity
- J. Comparing the recorded report with the original plan

Project Scheduling

For task Planning, separated the undertaking in various Work Breakdown Structure (WBS) to appoint labor and length of every activity. The work breakdown structure is depicted beneath:

Survey and Preconstruction work which contains every one of the activities and questions be assembled or taken to the site territory. Like temporary

structures namely site office, testing laboratory, Store room, Inventory Room and others are to be provided to begin working at the site. Such exercises are important to begin another task to oversee the working on site easily.

Step 1- To create enterprise project of a company to execute company profile.

In this step, creation of the company profile with division in which company operates was prepared. These divisions were further subdivided into streams such as Structure Urban and Structure Rural.

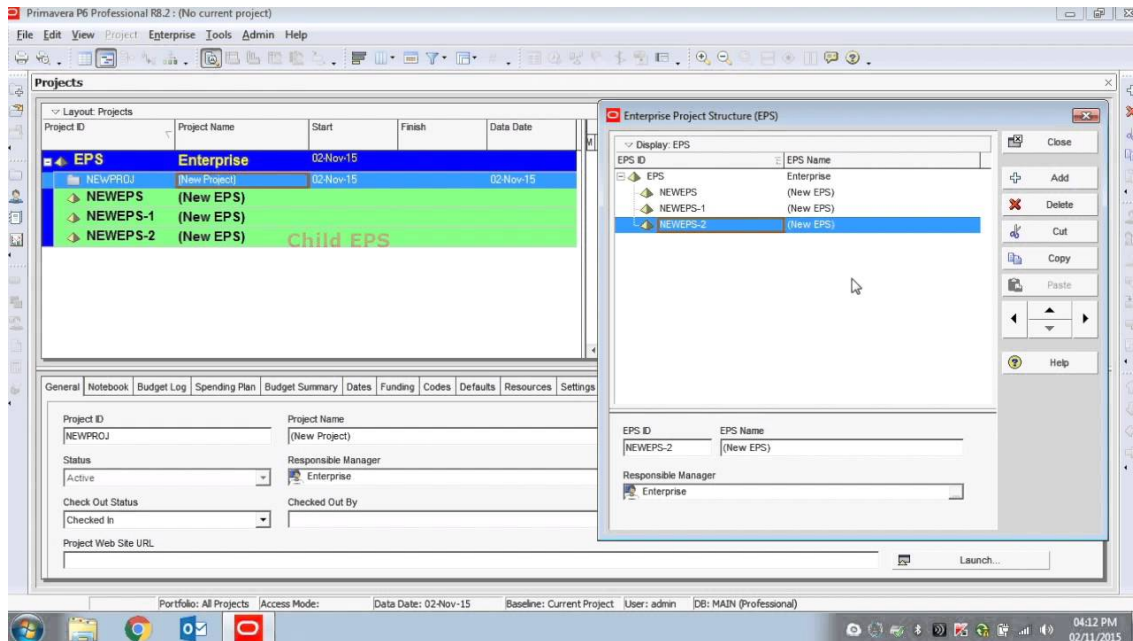


Fig 1 Creating Enterprise and Project.

Step 2- Assigning roles and organization structure constituting of company management and responsible manager's profile.

The job roles are assigned one the expertise of the employee and the task are assigned as per their qualifications and their experience in the similar tasks as efficient resources are responsible for completion of any project in right intervals and are important for development ventures.

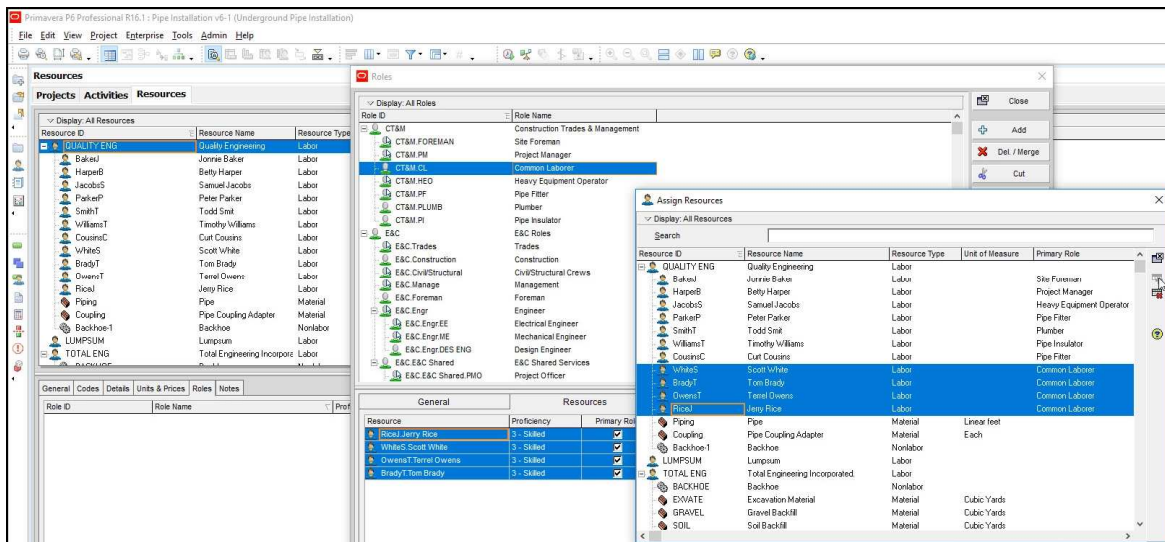
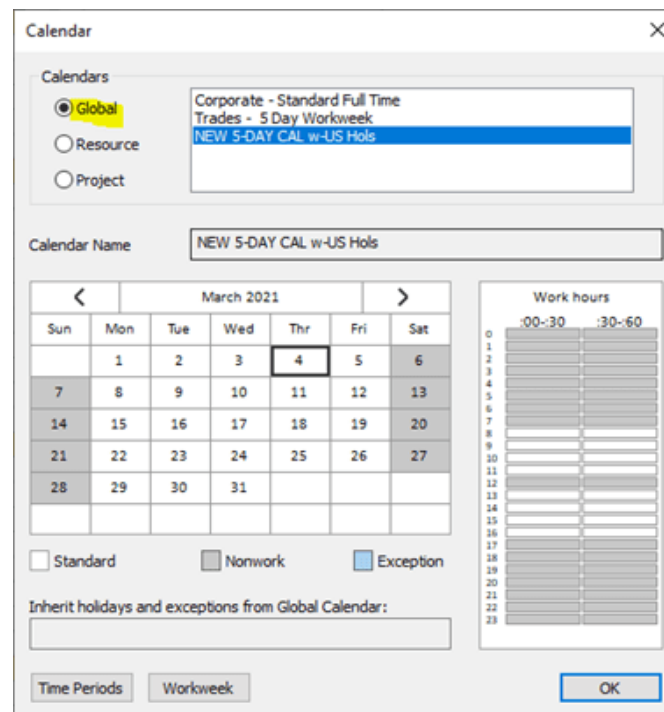


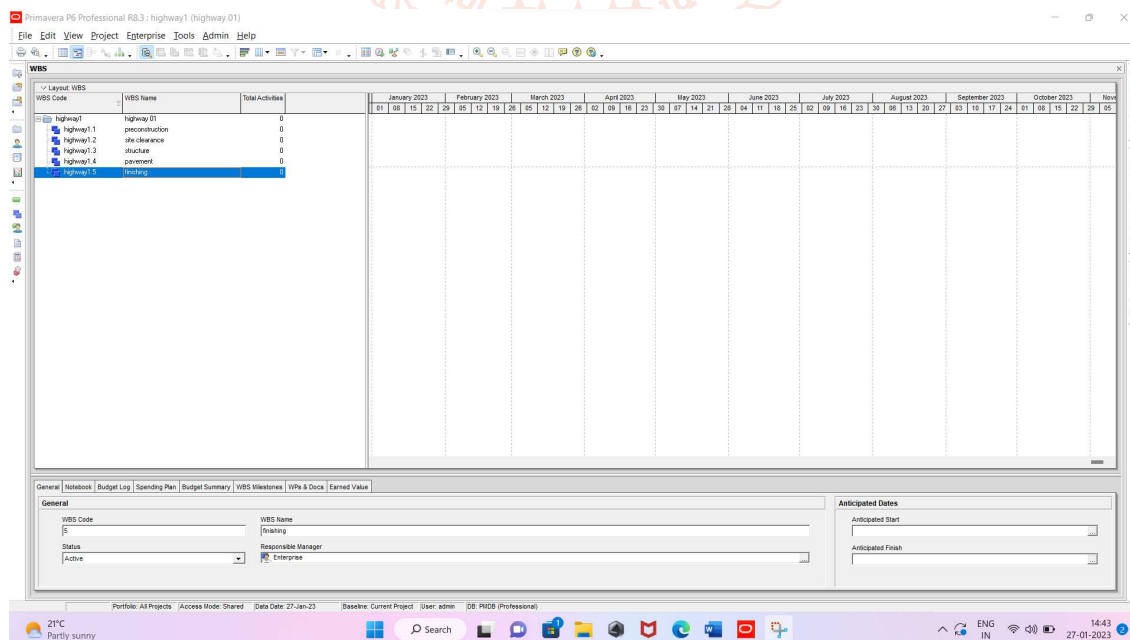
Fig 2 Assigning Resources

Step 3- Creating working calendar as per working hours and shifts to be assigned in project:

Before the start of project, the activity list is entered and the calendar are characterized and utilized to display the working time for every action in the task. Calendars are additionally used to characterize the working and occurrence design over the length of the task. These are three unique kinds of schedules namely Global, Venture and customized. The working shift is considered as 8 hours and six days working. The point to point working hours are from 08:00 AM to 05:00 PM. Meal break is of an hour from 12:00 PM to 01:00 PM.

**Fig 3 Global Calendar****Step 4- Preparing Work Breakdown Structure**

A WBS is the progression of work used to achieve the project to finish a task. WBS is organized in levels work point by point starting with final task and latter formation of different forms into identifiable work components. WBS is based on the individual sub venture and the undertaken WBS is figured beneath:

**Fig WBS Structure****Step 5- Assigning activities of each WBS as per scheduling data with links in between activities using Gantt chart.**

Critical advance in the undertaking arranging is to distinguish the activities to finish the task and furthermore anticipate or valuate the number of days required in completion of the project. The term of exercises is evaluated based on meetings, research, estimation and strategies of costing. These lengths are relegated in every activity. As the undertaking is of tedious kind, in order to identify the approach connected by utilizing CPM as PP apparatus.

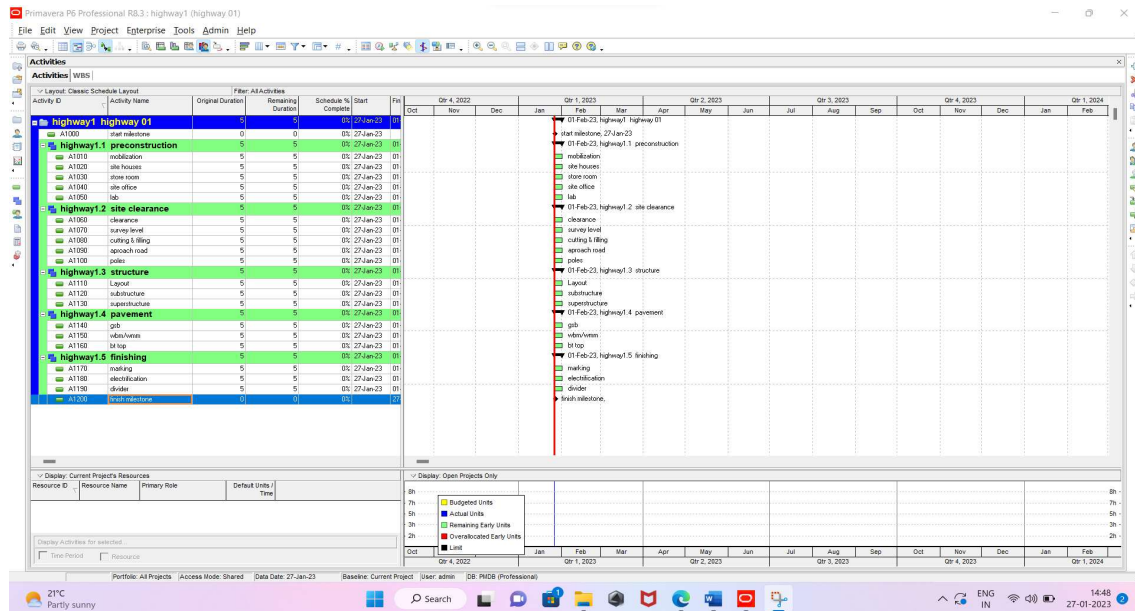


Fig Assigning Activities as per the construction phase.

Step 6- Creating Resources (Manpower, Machinery and Material)

The assets are prepared using big business asset, where an option is received get the choice of including new assets. Cost of assets relies on its unit as cost of work is on daily wages, material relies on their weight and machinery relies on its working hours along with its maintenance.

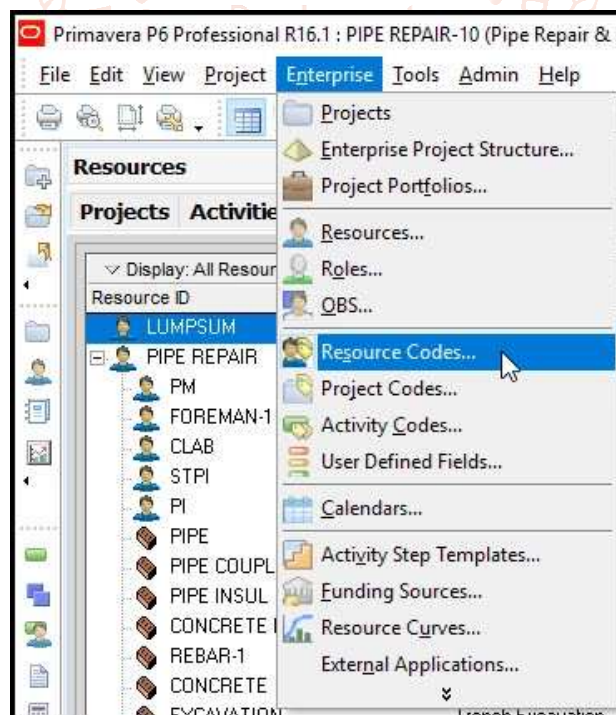


Fig Resource Analysis

Step 7- Assigning Resources in each activity as per IS. 7272

IS 7272 provide inexact necessity of labour according to the assigned activity. It provides consistent to working labour according to sort of work, this code depends on the prerequisite of work for exercises relying on the jobs required for usage.

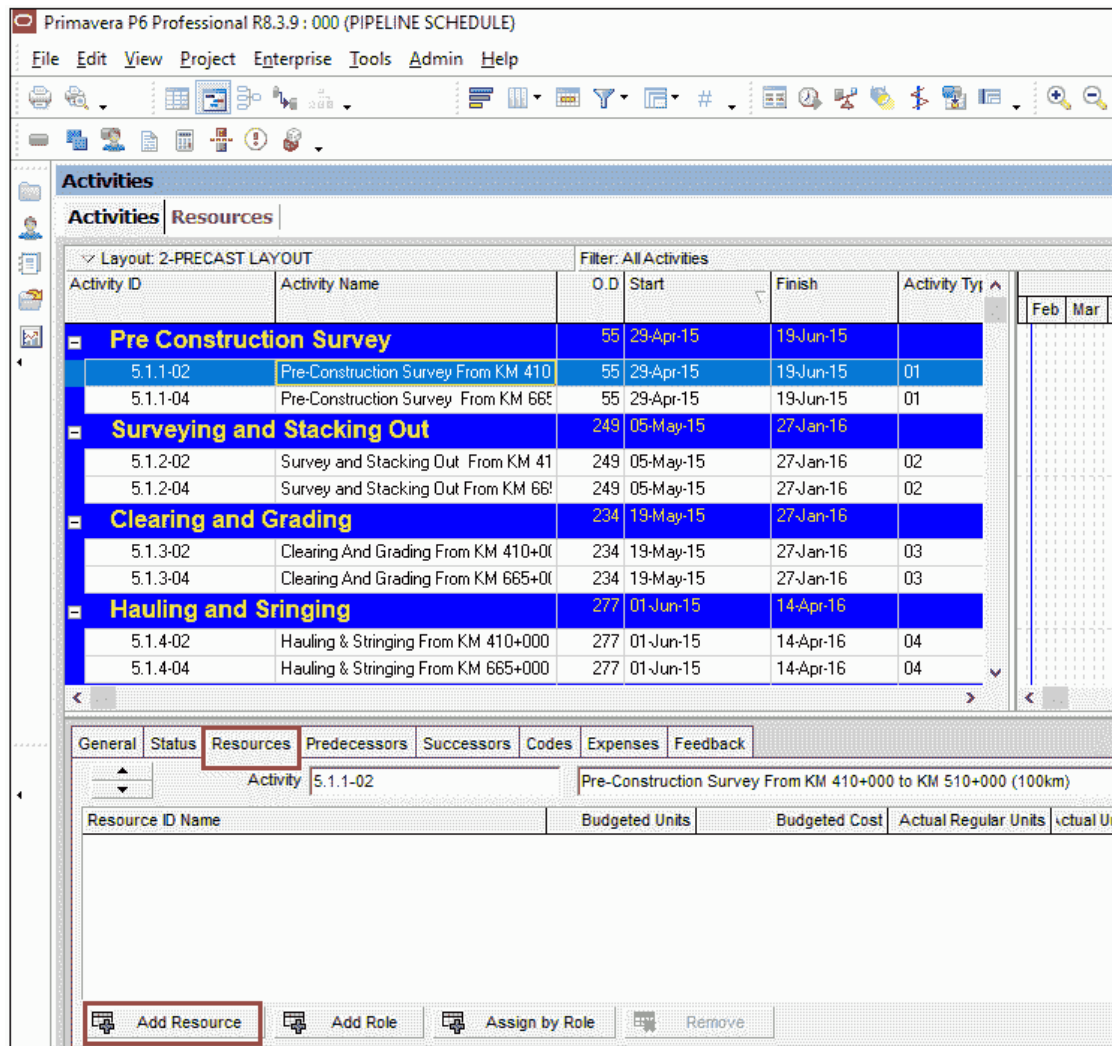


Fig Assigning Activities to the Resources

Step 8- Comparison of scheduling proposed as per site scheduling using Primavera P6.

Primavera provides another instrument to correlation of standard versus current advancement of the task known as Project Scheduling. It furnishes with legitimate booking and checking of every last exercise managing and investigating different parameters.

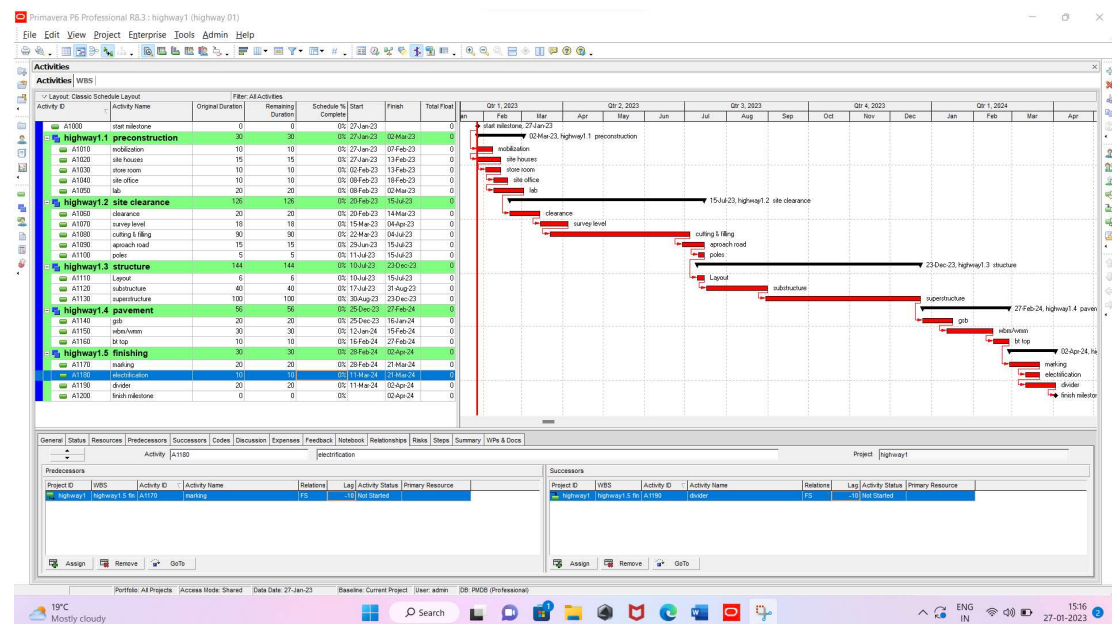


Fig Proposed Scheduling.

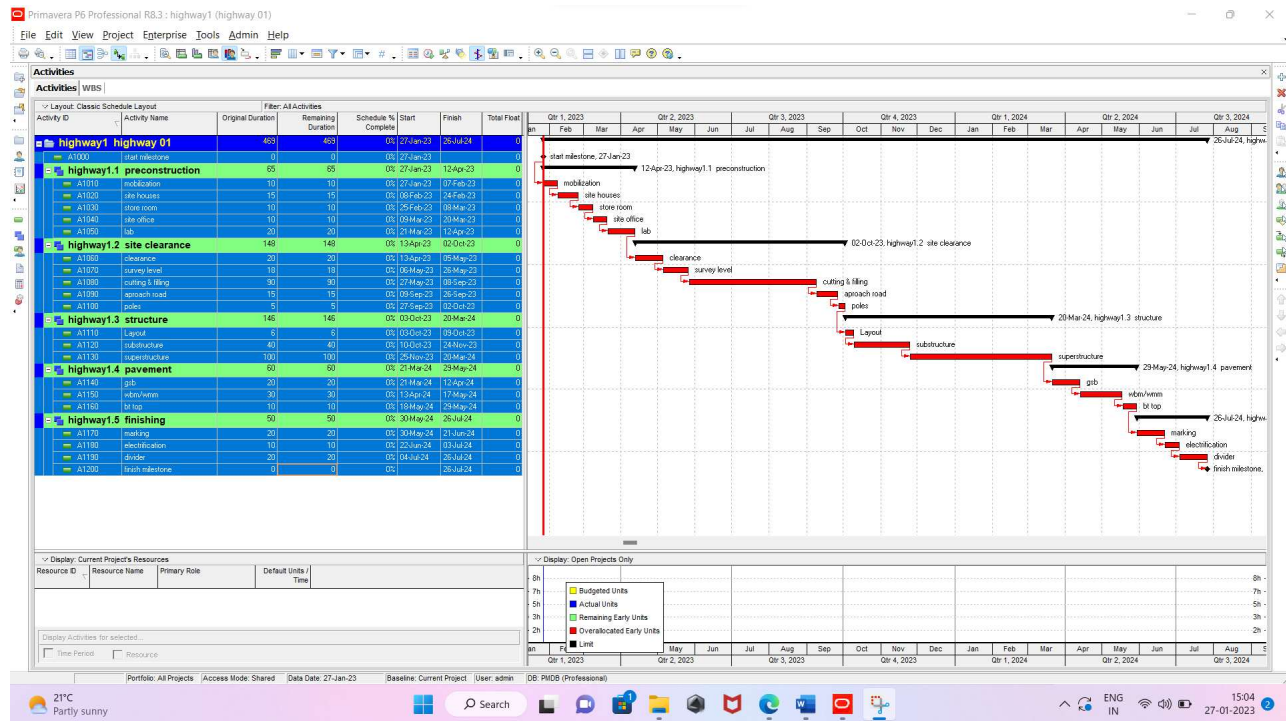


Fig Delay in Schedule.

Flow Chart

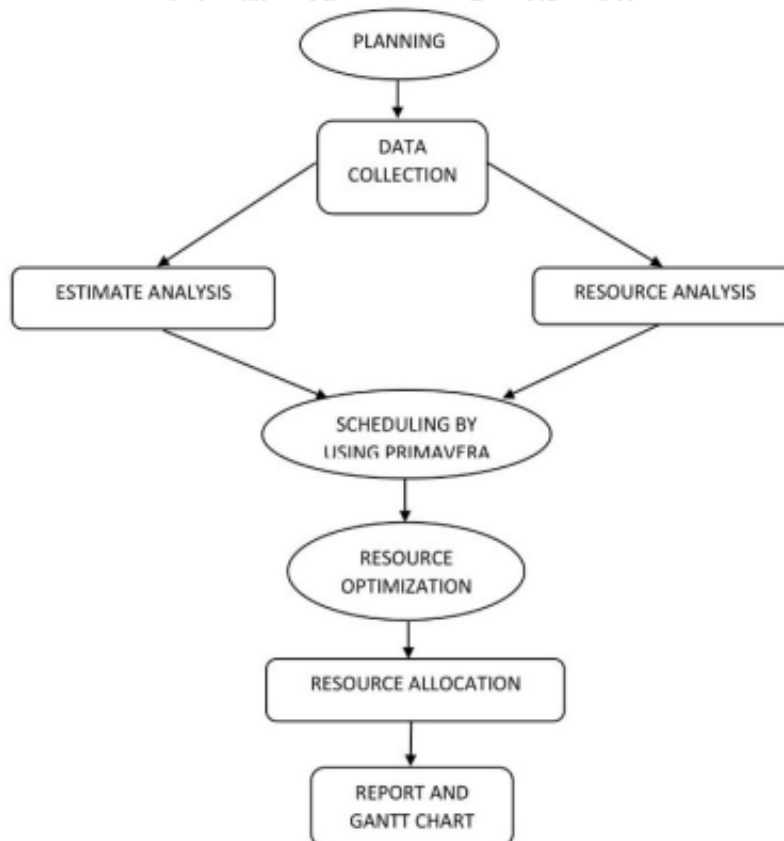


Fig Flow Chart of Methodology

RESULTS & DISCUSSIONS

1. General

This research is focused towards analyzing the reasons for the delay in planning and scheduling of the case study as described in section 4. The results were summarized on evaluating the proposed day and delay in schedule. Reasons for delay in construction were identified along with relative importance index and the variation of completion of work was done in percentage defining the difference whether it's complete or incomplete.

2. Evaluating Proposed and Delay

Table 1.1 Delay v/s Proposed

| Activity ID | Activity Name | Delay | | Proposed | |
|------------------|-------------------|------------|------------|------------|------------|
| | | Start | Finish | Start | Finish |
| A1000 | Start Milestone | 27/01/2023 | 26 Jul 23 | 27/01/2023 | |
| Preconstruction | | 27/01/2023 | 12/04/2023 | 27/01/2023 | 02/03/2023 |
| A1010 | Mobilization | 27/01/2023 | 07/02/23 | 27/01/2023 | 07/02/2023 |
| A1020 | Site Houses | 08/02/2023 | 24/02/2023 | 27/01/2023 | 13/02/2023 |
| A1030 | Store Room | 25/02/2023 | 08/03/2023 | 02/02/2023 | 18/02/2023 |
| A1040 | Site Office | 09/03/2023 | 20/03/2023 | 08/02/2023 | 02/03/2023 |
| A1050 | Lab | 21/03/2023 | 12/04/2023 | 20/02/2023 | 02/03/2023 |
| Site Clearance | | 13/04/2023 | 2/10/2023 | 20/02/2023 | 15/07/2023 |
| A1060 | Clearance | 13/4/2023 | 05/05/2023 | 20/02/2023 | 14/03/2023 |
| A1070 | Survey Level | 06/05/2023 | 26/05/2023 | 15/03/2023 | 04/04/2023 |
| A1080 | Cutting & Filling | 27/05/2023 | 08/09/2023 | 22/03/2023 | 04/07/2023 |
| A1090 | Approach Road | 09/09/2023 | 26/09/2023 | 29/06/2023 | 15/07/2023 |
| A1100 | Poles | 27/09/23 | 02/10/2023 | 11/07/2023 | 15/07/2023 |
| Structure | | 03/10/2023 | 20/03/2024 | 10/07/2023 | 23/12/2023 |
| A1110 | Layout | 03/10/2023 | 09/10/2023 | 10/07/2023 | 15/07/2023 |
| A1120 | Substructure | 10/10/2023 | 25/11/2023 | 17/07/2023 | 31/08/2023 |
| A1130 | Superstructure | 25/11/2023 | 20/03/2024 | 30/08/2023 | 23/12/2023 |
| Pavement | | 21/03/2024 | 29/05/2024 | 25/12/2023 | 16/01/2024 |
| A1140 | GSB | 21/03/2024 | 12/04/2024 | 25/12/2023 | 16/01/2024 |
| A1150 | WBM/WMM | 13/04/2024 | 17/05/2024 | 12/01/2024 | 15/02/2024 |
| A1160 | Bitumen Top | 18/05/2024 | 29/05/2024 | 16/02/2024 | 27/02/2024 |
| Finishing | | 30/05/2024 | 26/07/2024 | 28/02/2024 | 02/04/2024 |
| A1170 | Marking | 30/05/2024 | 21/06/2024 | 28/02/2024 | 21/03/2024 |
| A1180 | Electrification | 22/06/2024 | 03/07/2024 | 11/03/2024 | 21/03/2024 |
| A1190 | Divider | 04/07/2024 | 26/07/2024 | 11/03/2024 | 02/04/2024 |
| Finish Milestone | | | 26/07/2024 | | 02/04/2024 |

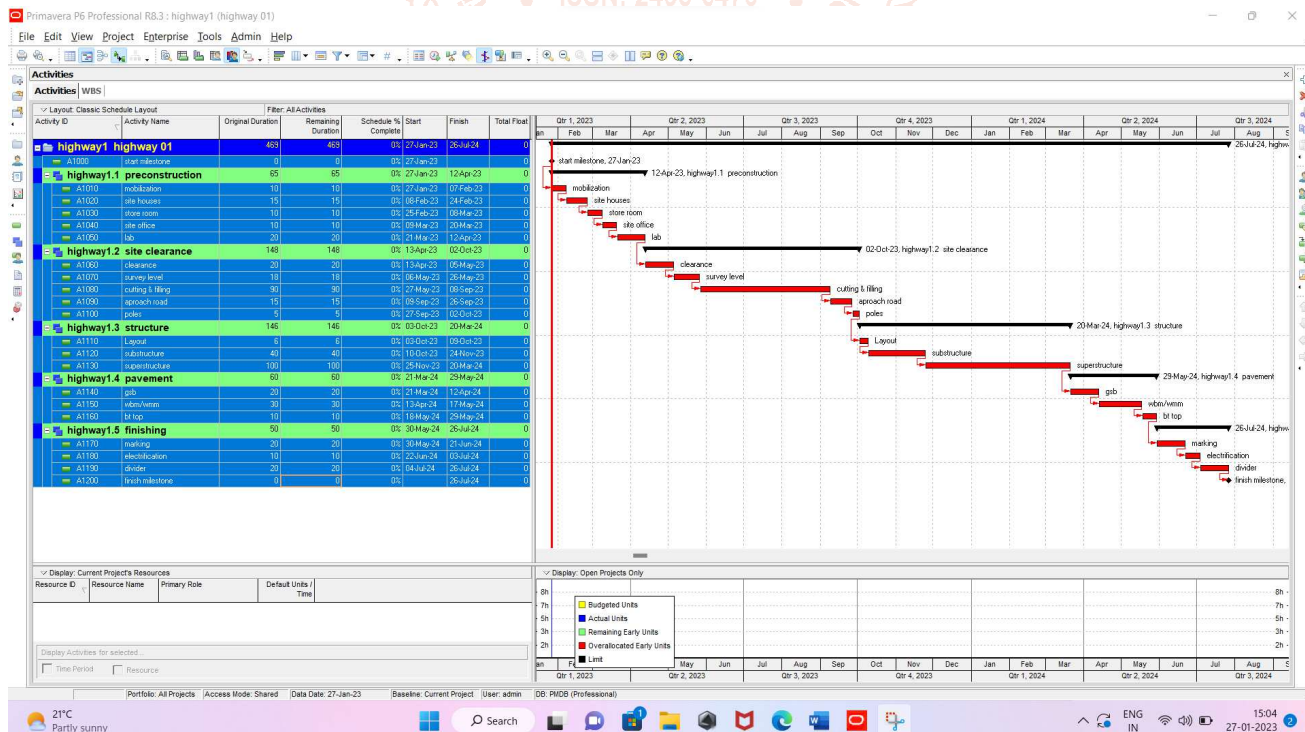


Fig Delayed Schedule

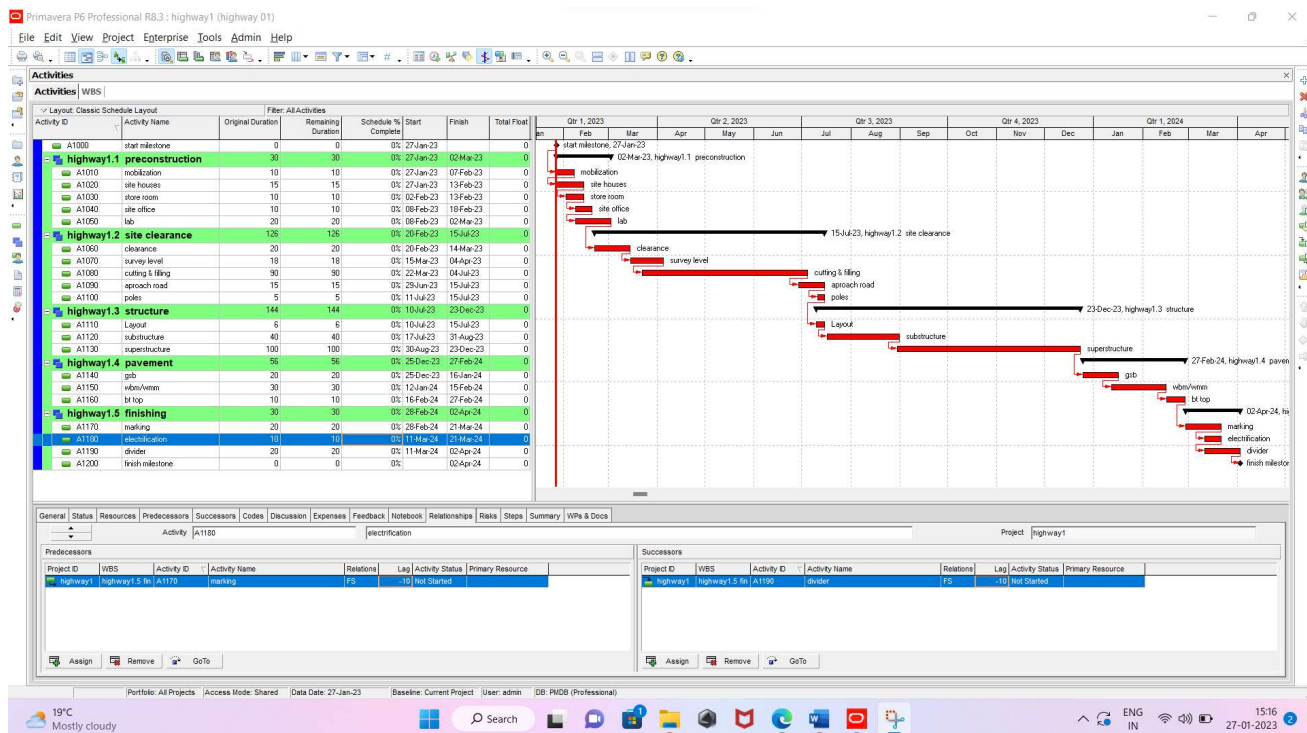


Fig Proposed Schedule

Inference- as per the table above, the delay of 89 days is visible as per the plan and the reasons of the delay are visible from the stage of construction of site houses and the scheduling is regularly delayed till the end of milestone with numerous reasons for lack of resources and in efficiency.

3. Construction Delay

Time is money, and that is particularly true on a construction project. When construction projects don't run on time - the contractor suffers because his overhead and expenses increase (eating into profits), and the owner suffers because he cannot open his new business on time, which causes lost profits that he could have been gaining. So, keeping projects on their critical path schedules is very important. Nevertheless, delays on massive construction projects are common due to construction projects being difficult and involving plenty of various players. Everyone has to be working together seamlessly to avoid delays. When a project is delayed, the question that is inevitably asked is who is responsible, if anybody, for the costs associated with the delay. This will, of course, rely fully on the language within the contract governing the project.

4. Delay Analysis Results

The following reasons were determined throughout this project work, which may be controlled accountable for delays

- Lack of information regarding advanced construction techniques.
- Lack of trained workers.
- Lack of fund flow throughout the project progress.
- A major portion of working labor is from Andhra Pradesh and Bihar. Regional festivals in these areas cause fast delays in work progress.
- Sudden extension of monsoon rain caused a delay in a project's progress.
- Sand non-availability because of legal restrictions.
- Late delivery of resources.
- Improper planning of construction activities.
- Unforeseen underground utilities and overhead utilities are shifting/diversion delay.
- Improper utilization of available resources.

5. Reason for Delay

Table Reason for delay

| Reason for delay | Delay in days |
|--------------------------------------|---------------|
| Traffic permission / diversion delay | 32 |
| Design issue | 28 |
| Shortage of skilled labor | 23 |
| Shortage of Materials | 13 |
| Shortage of machinery | 16 |
| Weather condition (Rain) | 34 |
| Utility issues | 16 |
| Cash flow issues | 21 |
| Land acquisition | 26 |
| | 209 |

Inference- Gap of 209 days is visible due to numerous reasons which include time occupied in land acquisition, issues found in cash flow, shortage of machinery and shortage of materials.

6. RII (Relative Importance Index)

The relative index of inequality (RII) is a regression-based index which summarizes the magnitude of socioeconomic status (SES) as a source of inequalities in health. RII is useful because it takes into account the size of the population and the relative disadvantage experienced by different groups.

Table Ranking of Delay Factors

| Factors | RII | Rank |
|--|------|------|
| Project Work delays due to late delivery of material | 0.71 | 1 |
| Shortage of equipment in construction site | 0.68 | 2 |
| Does the poor quality of construction material affect the productivity? | 0.66 | 3 |
| Lack of adequate project information to employees arise major cause of delay in construction projects? | 0.66 | 3 |
| If, any injuries and accidents during construction? | 0.66 | 3 |
| Due to unclear and inadequate details in drawings affects the project schedule? | 0.65 | 4 |
| Implementation of improper construction methods execution in project site reduces the workability? | 0.63 | 5 |
| Are you aware of the use of earthwork equipment? | 0.63 | 5 |
| Lack of design standards for protecting structures from earthquakes | 0.63 | 5 |
| Rework due to errors during construction | 0.63 | 5 |

The disease outcome is regressed on the proportion of the population that has a higher position in the hierarchy

$$RII = \Sigma W / (A * N)$$

Where, W is the weighting given to each factor by the respondents (ranging from 1 to 4), A is the highest weight (i.e. 5 in this case), and N is the total number of respondents. Higher the value of RII, more important was the cause of delays.

Work Completion

| Items of Work | % Complete | % Incomplete |
|--------------------------------|------------|--------------|
| Road Side Drains | 1.57 | 98.43 |
| Road Signs, Marking, km Stones | 0 | 100 |
| Crash Barries | 0 | 100 |
| Bus Bys and Rest Areas | 0 | 100 |
| Plantation- Road Side | 0 | 100 |
| Misc. work | 51 | 49 |

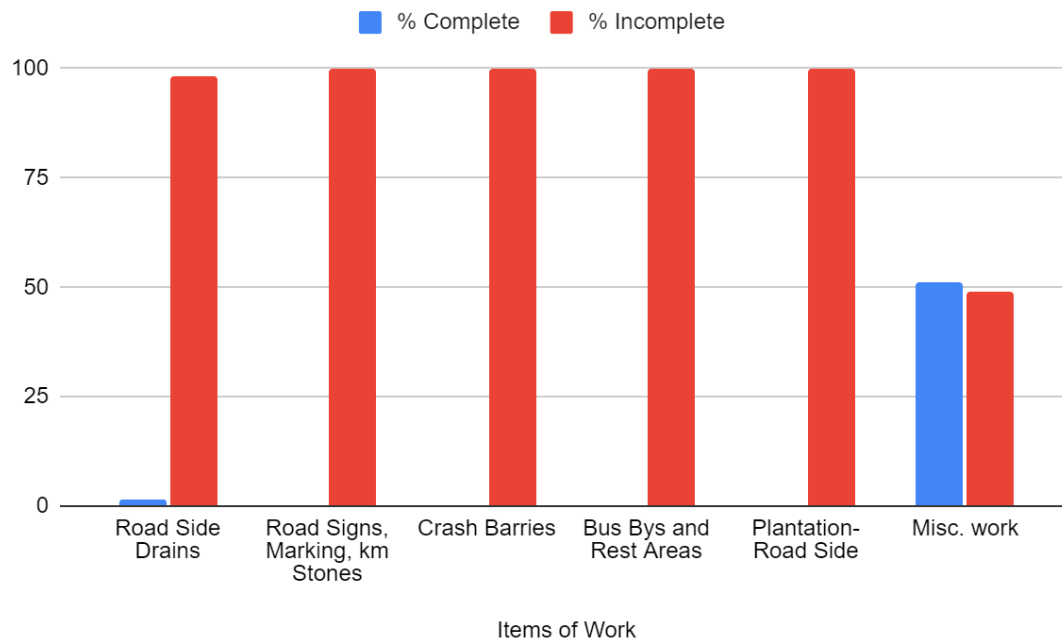


Fig Work Completion in percentage

Inference- Maximum work is expected to complete by April 2024 hence most of the work lies in the stage of being incomplete.

7. Cause Identification

A. Causes related to owner

- Interference in work by owner: interference in work was ranked as the first severest cause related to owner. According to conditions of contract, the owner has the right to suspend any part of work if it is required to restudy or redesign the project to make the necessary modifications. If interference by owner will frequent without reason it may obstruct the work of contractor, and causes delay for the project.
- Delay in decision making: The results indicated that delay in decision making is the second severest cause related to owner. Slowness of owner in making decisions may hold back some of project activities, and delay in settlement of contractor's claims by the owner, such as approval of new work items, prices and additional costs for changes in design. This may obstruct the progress of work and subject the project for delay.
- Delay in progress payments by owner: the results shows that progress payment is third severest cause related to owner. This may occur due to unavailable financial resources to other projects. Without providing the budget, the project remains only in papers without execution.

B. Causes related to contractor

- Ineffective construction method implemented by contractor: this was ranked as the first severest cause related to contractor. Contractors may fail to come out with a practical work program at the

initial work stage. This failure is interrelated with lack of effective methods of construction and insufficient contractor's experience towards the projects. Improper planning at the initial stages of a project causes delays at various stages.

- Shortage of materials: The contractor obligates himself to provide the required equipment and materials to execute the project within the time schedule. Shortage or unavailability of the required equipment and materials may obstruct the progress of work and may subject the project for delay.
- Payment problems between contractor and his employees: Some contractors encountered reduction in their financial resources due to the "Credit Crunch", the global financial crisis. Cash requirement for procurement of materials and other expenses could lead the contractor into a very critical situation which may obstruct the progress of work and postpone the project completion time.

C. Causes related to consultant

- Results showed that there are three severe causes related to consultant, these are: Delay in solving design problems, Major change of design during construction by consultant, Bad project cost estimation. It can be observed that these causes are related to insufficient experience of the consultant's staff. When consultant makes fundamental changes in design, the contractor may face difficulties in construction or in finance

because these changes weren't planned. Moreover, when projects' costs are underestimated, it may be suspended by the owner due to his inability to finance additional costs. Additionally, delay in approvals by consultant could delay the progress of work and may cause delay in completion time of the project.

D. Causes related to services and utilities

- All causes related to services and utilities were ranked as frequent and severe, which indicates the importance of this group. Utilities are unidentified or incorrectly located is ranked as the first most frequent and severest cause in this group. This may result from unavailability of designs and exact location maps. Unclear or undefined positions of services networks in drawings can subject the project to delay; because the schedule will be changed and the newly discovered pipe or cable is required to be moved or diverted temporarily which requires additional time and money.

E. Causes related to Government regulations

- Difficulties in obtaining work permits: Among the severest problems related to Government regulations which affect the progress of public road projects is the issuance of work permits. The contractor must obtain work permits from all concerned Government authorities. Each of these authorities has its own regulations and rules in issuing work permits. Contractor may face difficulties in obtaining these permits causing delay for the project.
- Tendering system requirement of selecting the lowest bidder: It is important to reconsider the governmental strategies that encourage the selection of the lowest bidding contractors and to improve the routine procedures and requirements that are required for obtaining work permits.
- Land acquisition: Land acquisition is a sensitive issue so humane, systematic and transparent approach need to be adopted for early and peaceful acquisition. Land acquisition must take place in a manner that fully protects the interests of land-owners and also of those whose livelihoods depend on the land being acquired. So an adequate compensation package which shall include reasonable compensation for land and resettlement and rehabilitation measures to assuage the sufferings of the affected persons and projects.

F. Causes related to external environment

- Traffic diversion: Traffic diversion is found to be the first severest and most frequent cause related

to external environment. Improving the performance of an intersection by constructing a flyover and / or subway involves working at already used highway. If this highway is linking between important regions in the country, it is difficult to close it until the construction finishes. Congestions in this highway are required to be diverted for temporary ways and this may obstruct the progress of work and causes delay for the project.

- Hot weather effect on construction activities: The climate in Bahrain is very hot, where the temperature may exceed 49 °C in summer which makes the construction very difficult. The weather may affect the productivity of labours and equipment, which may delay the progress of work.

Scarcity of materials in the market: The factor "scarcity of materials in the market" was Ranked third. Construction projects are physical projects, and the timely availability of Materials is very important.

CONCLUSION & FUTURE SCOPE

CONCLUSIONS

Schedule

as per the table above, the delay of 89 days is visible as per the plan and the reasons of the delay are visible from the stage of construction of site houses and the scheduling is regularly delayed till the end of milestone with numerous reasons for lack of resources and in efficiency.

Construction Delay

Time is money, and that is particularly true on a construction project. When construction projects don't run on time - the contractor suffers because his overhead and expenses increase (eating into profits), and the owner suffers because he cannot open his new business on time, which causes lost profits that he could have been gaining. So, keeping projects on their critical path schedules is very important.

Reasons for Delay

Gap of 209 days is visible due to numerous reasons which include time occupied in land acquisition, issues found in cash flow, shortage of machinery and shortage of materials.

RII

The relative index of inequality (RII) is a regression-based index which summarizes the magnitude of socioeconomic status (SES) as a source of inequalities in health. RII is useful because it takes into account the size of the population and the relative disadvantage experienced by different groups.

Completion of Work

Maximum work is expected to complete by April 2024 hence most of the work lies in the stage of being incomplete.

Future Scope

In this research, we have studied the causes of delay in highway construction. It is recommended to study further and analyze the cost of delay in this project.

REFERENCES

- [1] R. Santhosh Kumar and Anoop James Antony, [Experimental Investigation on Preplanning of Road Construction by Using Primavera], International Journal of Innovative Research in Science, Engineering and Technology, Vol. 7, Issue 5, May 2018.
- [2] Ankush Suryabhan Harle and Rahul D. Shinde, [DELAY ANALYSIS IN RESIDENTIAL PROJECT BY USING GENETIC ALGORITHM], INTERNATIONAL JOURNAL OF ADVANCE SCIENTIFIC RESEARCH AND ENGINEERING TRENDS, || Volume 5 || Issue 2 || February 2020.
- [3] Ahmed Taghi Multashi and Rohit R. Salgude, [Delay Analysis in Construction Project a Case Study-Alkut Olympic Stadium], International Journal of Science and Research (IJSR), Volume 5 Issue 6, June 2016.
- [4] Kartik Bagrecha and Ayushi Bais, [STUDY ON DELAY CONSTRUCTION PROJECT IN INDIA], INTERNATIONAL JOURNAL OF INNOVATIONS IN ENGINEERING RESEARCH AND TECHNOLOGY [IJERT] ISSN: 2394-3696 VOLUME 4, ISSUE 11, Nov.-2017.
- [5] S. Revathy and Dr. S. Kamal, [A STUDY ON FACTORS AFFECTING THE CONSTRUCTION PROJECTS SCHEDULING], International Journal of Advance Research in Science and Engineering, Vol no.6. Issue no 4, April 2017.
- [6] Chaitali B Guledagudd and Vijay B G, [Scheduling and Monitoring of Ongoing Bypass Construction Connecting NH 218 & NH 63 Using Primavera P6], International Journal of Application or Innovation in Engineering & Management (IIAEM), Volume 7, Issue 5, May 2018, ISSN 2319 - 4847.
- [7] Dilip Kumar E and Manishankar S, [Delay Analysis of Flyover Bridge Construction Using Primavera], SSRG International Journal of Civil Engineering Volume 6 Issue 5, 1-5, May 2019, ISSN: 2348 – 8352.
- [8] Parth Viradia and B Prakash Rao, [PLANNING, SCHEDULING AND DELAY ANALYSIS OF A BUILDING], International Journal of Civil Engineering and Technology (IJCIET) Volume 9, Issue 5, May 2018, pp. 665–671.
- [9] T. Subramani, M. Kannan, P. Vinoth, K. Mohan Doss and S. Priyanka, [Cost Escalation And Delays In Construction Industry Using SPSS], International Journal of Emerging Trends & Technology in Computer Science (IJETTCS), Volume 7, Issue 2, March - April 2018.
- [10] Saradha. P and R. Santhosh kumar, [DELAY ANALYSIS IN CONSTRUCTION PROJECT USING MS PROJECT & SPSS], INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH EXPLORER VOLUME 5, ISSUE 6, JUNE/2018 ISSN NO: 2347-6060.
- [11] Praveen Kumar. S and A. Krishnamoorthi, [PLANNING AND ANALYSIS OF HIGHWAY BRIDGE USING MICROSOFT PROJECT AND PRIMAVERA 6], International Research Journal of Engineering and Technology (IRJET), Volume: 07 Issue: 09 | Sep 2020.
- [12] SelvaKumar M and Manishankar S, [Delay Analysis of Highway Construction Using Primavera], Emperor Journal of Applied Scientific Research, ISSN No. 2581-964X, 2020, Vol 2, issue 5.
- [13] Suvarna N. Desai and Dr. A. W. Dhawale, [STUDY THE APPLICATION OF PRIMAVERA IN PLANNING AND SCHEDULING OF PREFABRICATION TECHNOLOGY USED IN CONSTRUCTION], Journal of Emerging Technologies and Innovative Research (JETIR), February 2019, Volume 6, Issue 2, ISSN-2349-5162.
- [14] Piyush Pramod Bagde and Abhijit N. Bhirud, [Project Management by Using Primavera P6 Software], Journal of Advances and Scholarly Researches in Allied Education Vol. XV, Issue No. 2, (Special Issue) April-2018, ISSN 2230-7540.
- [15] P. Esakki Thangam and R. Magdalene Benila, [Planning, Scheduling and Time Management

- of Six Lanes Road Construction Work at V.O.C Port Trust using Primavera P6 Software], International Journal of Science Technology & Engineering | Volume 2 | Issue 11 | May 2016.
- [16] Michael Raj and M. Panimalar, [Resource Scheduling of Construction Project: Case Study], International Journal of Science and Research (IJSR), Volume 4 Issue 5, May 2015.
- [17] Sushma. H, Bhavya. S, Rajeeva S.J and G. Narayan, [Planning, Scheduling and Resource Optimization for Road Construction Using Primavera], INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH IN TECHNOLOGY, Volume 4 Issue 3 | ISSN: 2349-6002, August 2017.
- [18] Balakrishna Ch, Anand Goud K, Akula Prakash and Kandlagunta Mounika, [Schedule delay analysis of a multi-storied residential project using primavera], IOP Conf. Series: Materials Science and Engineering 1091 (2021) 012038.
- [19] Abdul Aziz and Sanjeet Kumar, [Financial and Work Management Analysis for Residential Construction: a Case Study], International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277- 3878, Volume-7, Issue- 6C2, April 2019.
- [20] AjeshPilaniya and Ashwin A. Mahajan, [A Review of Planning & Scheduling of a Pune Metro Rail Project using Primavera P6 Web], IJTSRD - International Journal for Scientific Research & Development| Vol. 6, Issue 09, 2018 | ISSN: 2321-0613.
- [21] AkashRajkumarWadhwa and DATTATRAY SANTRAM SHINDE, [PROJECT MANAGEMENT USING PRIMAVERA P6.2], INTERNATIONAL JOURNAL OF INNOVATIONS IN ENGINEERING RESEARCH AND TECHNOLOGY [IJIERT], ISSN: 2394-3696, VOLUME 3, ISSUE 11, Nov.-2016.
- [22] Akshay R. Kohli, [Enterprise Project Management using Primavera P6 EPPM], International Research Journal of Engineering and Technology (IRJET), Volume: 04 Issue: 12 | Dec-2017, Impact Factor value: 6.171.
- [23] Alberto Cerezo-Narváez, Andrés Pastor-Fernández, Manuel Otero-Mateo and Pablo Ballesteros-Pérez, [Integration of Cost and Work Breakdown Structures in the Management of Construction Projects], Appl. Sci. 2020, 10, 1386; doi:10.3390/app10041386.
- [24] AnuragMahure and AmitkumarRanit, [Planning, Scheduling and Tracking of building Using Primavera P6], International Journal of Engineering Science Invention (IJESI), Volume 7 Issue 8 Ver III || Aug 2018 || PP 60-64.
- [25] AnuragMahure and AmitkumarRanit, [Project Management using Primavera P6], International Journal of Engineering Research & Technology (IJERT), ISSN: 2278-0181, Vol. 7 Issue 04, April-2018.
- [26] ArindamDebnath, M. Srinivas, Raghavendra Rao and KalaswamyNaik, [Project Monitoring and Controlling, Reach -2b, Phase-2 BMRCL], International Journal for Scientific Research & Development| Vol. 5, Issue 08, 2017 | ISSN: 2321-0613.
- [27] V. Dhanalakshmi, "High Cost Infrastructure Report Monitoring by P6 Software", International Conference on Engineering Innovations and Solutions (ICEIS), 2016.
- [28] T. Siva Nagaraju and Sri Lakshmana Kumar, "Schedule And Resources Optimization Using Primavera In Metro Rail Project, International Journal Of Mechanical And Production Engineering", ISSN: 2320-2092, Volume- 4, Issue-7, Jul.-2016.
- [29] Maheshwar S Maregoudru, Monish Kumar K, Ashwija K C and Sparsha B, "Cost Analysis of Road Construction Project by Earned Value Analysis using Primavera P6", International Research Journal of Engineering and Technology (IRJET), Volume: 04 Issue: 07, July -2017.
- [30] Vishnuraj RG and Vishak MS, "Optimization of Resources in Highway Construction, International Journal of Engineering and Management Research (IJEMR)", Volume-7, Issue-2, March-April 2017.
- [31] Sushma. H, Bhavya. S, Rajeeva S.J, and G. Narayan, "Planning, Scheduling and Resource Optimization for Road Construction Using Primavera", IJIRT, Volume 4 Issue 3, August 2017.
- [32] T. Subramani and M. Sekar, "Preplanning And Scheduling Of Road Construction By Using PPM", International Journal of Application or Innovation in Engineering & Management (IIAIEM), Volume 4, Issue 5, May 2015.
- [33] P. Esakki Thangam and R. Magdalene Benila, "Planning, Scheduling and Time Management of Six Lanes Road Construction Work at V.O.C

- Port Trust using Primavera P6 Software”, International Journal of Science Technology & Engineering (IJSTE), Volume 2 Issue 11, May 2016.
- [34] Unmesh. Y. Polekar and Rohit R Salgude, “Planning, Scheduling and Tracking of a residential Project using Primavera Software”, International Journal of Advance Research in Computer Science and Management Studies, Volume 3, Issue 5, May 2015.
- [35] Primavera Foundation, Synergy School of business skills, A division of CADD Centre training services Pvt. Ltd. 1
- [36] Daniel L. Williams and Elaine Britt Krazer, Project and Portfolio Management, Oracle Primavera P6 version 8.
- [37] Primavera P6 Project Management, reference manual, version 6.2.1.

